Entrance Test Syllabus (NEP)

for

2-Year PG Programme in Electronics offered at the Department of Electronics and Instrumentation Technology, *University of Kashmir, Srinagar*

(Effective from Academic Session 2026)

UNIT-I: Circuit Analysis

Concept of Voltage and Current Sources. Kirchhoff's Current Law, Kirchhoff's Voltage Law. Mesh Analysis. Node Analysis. Star and Delta networks, Star-Delta Conversion. Principal of Duality. Superposition Theorem. Thevenin's Theorem. Norton's Theorem. Reciprocity Theorem. Maximum Power Transfer Theorem. Two Port Networks: h, y and z parameters and their conversion.

Unit-II: Semiconductor Devices-I

Junction Diode and its applications: PN junction diode (Ideal and practical)- I-V characteristics, dc load line analysis, Quiescent (Q) point. Zener diode, Rectifiers- Half wave rectifier, Full wave rectifiers (center tapped and bridge), ripple factor and efficiency. Zener diode as voltage regulator.
Bipolar Junction Transistor: Review of the characteristics of transistor in CE and CB configurations, Regions of operation (active, cut off and saturation), Current gains α and β. Relations between α and β. dc load line and Q point.

Unit-III: Semiconductor Devices-II

Unipolar Devices: JFET and MOSFET. Construction, working and I-V characteristics (output and transfer), Pinch- off voltage. Transistor biasing and Stabilization Circuits-Fixed Bias and Voltage Divider Bias. Thermal runaway, stability and stability factor S. Input and Output impedance, Current and Voltage gains. Class A, B and C Amplifiers. RC Coupled Amplifier and its Frequency Response. Concept of feedback, negative and positive feedback.

UNIT-IV: Number Systems, logic Gates and Combinational Logic Design

Decimal, Binary, Octal and Hexadecimal number systems, base conversions. Representation of signed and unsigned numbers, BCD code. Binary, octal and hexadecimal arithmetic; addition, subtraction by 2's complement method, multiplication. Logic Gates and Boolean algebra: Truth Tables of OR, AND, NOT, NOR, NAND, XOR, XNOR, Universal Gates, Basic postulates and fundamental theorems of Boolean algebra.
Standard representation of logic functions (SOP and POS), Minimization Techniques (Karnaugh map minimization up to 4 variables for SOP). Arithmetic Circuits: Binary Addition. Half and Full Adder. Half and Full Subtractor, 4-bit binary Adder/Subtractor. Multiplexers, De-multiplexers, Decoders, Encoders.

Unit-V: Sequential Logic Design

Flip Flops: SR, D, T and JK Flip-Flops. Clocked (Level and Edge Triggered) Flip-Flops. Preset and Clear operations. Race-around conditions in JK Flip-Flop. Master-slave JK Flip-Flop.
Shift Registers: Serial-in- Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out and Parallel-in-Parallel-out Shift Registers (only up to 4 bits).
Counters: Ring Counter. Asynchronous counters, Decade Counter. Synchronous Counter.
Logic Families: Characteristics of logic families- Fan-in, Fan out, Noise Margin, Power Dissipation, Figure of merit, Speed power product, RTL, DTL, ECL, TTL and CMOS.

UNIT-VI: Operational Amplifier and its Linear and Non-linear Applications

Operational Amplifiers: Basic differential Amplifier, Block Diagram of Op-Amp (IC 741), Characteristics of an Ideal and Practical Operational Amplifier, Open and Closed Loop configuration, Concept of Virtual Ground.
Op-Amp Parameters: Input Offset Voltage, Input Offset Current, Input Bias Current, Common Mode Rejection Ratio (CMRR), Slew Rate, Power Supply Rejection Ratio (PSRR).
Applications of Op-Amps: Inverting and Non-inverting Amplifiers, Summing and difference Amplifier, Instrumentation Amplifier, Differentiator and Integrator, Comparator and Schmitt Trigger.
Data Converters: Analog-to-Digital (Flash and Successive Approximation type), Digital-to-Analog Converters (Weighted Resistor and R-2R Ladder type).

Unit-VII: Operational Amplifier Based Filters, Oscillators and Timers

Active Filters using Op-Amps: First and Second Order Active Low Pass, high Pass, Band Pass and Band Stop Butterworth Filters.
Oscillators and Signal Generators: Barkhausen criterion for Sustained Oscillations, Phase Shift Oscillator, Wien-bridge oscillator, Square Wave Generator, Triangle Wave Generators.
IC 555 Timer: Introduction, Block diagram, Astable and Monostable multivibrator circuits.
Phase Locked Loops (PLL), Block Diagram and Characteristics, Overview of PLL Applications.
Voltage Regulators: Basic circuit configuration and characteristics, Basic blocks of linear voltage regulator, three terminal fixed regulators (78XX and 79XX), Concept of Adjustable and Switching Regulators.

UNIT-VIII: Signals and Systems

Representation and Classifications of Continuous and Discrete Time Signals and Systems; Linear and Nonlinear systems, Causal and non-causal Systems, Time varying and Time Invariant systems, Singularity Functions; Convolution Operation of Continuous and Discrete Time Signals; Impulse Response and Its Properties.
Fourier, Laplace and Z Transforms and their Properties, Sampling: Representation of a Continuous-Time Signal by its Samples, Sampling Theorem. Introduction to Random Variables; Probability Distribution and Probability Density Functions.

UNIT-IX: Microprocessor Architecture and Programming

Computer System: Central Processing Unit, Memory, I/O, System Bus; Von Neumann and Harvard Architectures, CISC and RISC Architectures; Introduction to Microprocessors, Characteristics of Microprocessors, Programmer's Model of Microprocessors. Introduction and Architecture of 8085 Microprocessor, 8085 Bus Structure, Addressing Modes, 8085 instructions set (Data transfer including stacks. Arithmetic, logical, branch, and control instructions), Subroutines, delay loops, Instruction and

Data Formats. Instruction Timing Diagram, Memory read/write Timing Diagrams. 8085 Interrupts. Programming of 8085 using Data Transfer, Arithmetic and logic Instructions.

Unit-X: Microcontroller Architecture and Programming

Introduction/Evolution and Applications of Microcontrollers, Comparison of Microprocessor and Microcontroller, Introduction and Architecture of 8051 microcontroller, Pin description of 8051 microcontroller, Input/Output Ports and Port circuits, Timers and counters, Serial data input/output Interrupts, register set and Addressing Modes of 8051, Instruction set of 8051 (data transfer/arithmetic/logic/bit level and byte control transfer instructions), Introduction to 8051 Assembly Language Programming.

Unit-XI: Analog Modulation and Demodulation

Basic Mathematical theory of A. M modulation, Time domain and Frequency domain representation, Generation and demodulation of AM Signal, Double Side band Suppressed Carrier, (DSB- SC) System, Generation and Demodulation of DSB- SC signals, Advantages of SSB transmission, Generation of SSB; Vestigial Side-Band Modulation (VSB). SSB and VSB demodulation, independent sideband transmission and reception. Concept of Angle Modulation, FM Generation and Detection

Unit-XII: Digital Modulation and Demodulation

Introduction to PCM, PAM and PWM. Review of Sampling Theorem, Signal Reconstruction: The Interpolation Formula, Elements of Pulse Code Modulation (PCM), Quantization: Uniform and Non-uniform Quantization, Companding Characteristics, Encoding. Differential PCM, Delta Modulation.

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Unit-XIII: Measurement, Meters and Bridges

Measurement and its Significance, methods of measurement. Basic definitions of instruments, Classification of instruments, Performance parameters: Accuracy, Precision, Sensitivity, Resolution, Errors, Significant figure. Construction and working, DC ammeter and voltmeter, Ammeter and Voltmeter loading, DC ohmmeters.
Digital Voltmeter: General Characteristics, Ramp type DVM, Successive approximation type DVM, Integrating type DVM.
Bridges: Types, Condition for Bridge balance. DC Bridges: Wheatstone Bridge, Kelvin double Bridge. AC Bridges: Maxwell Bridge, Hay bridge, Schering Bridge, Wein bridge, Sensors.

Unit-XIV: Sensors, Oscilloscope and Signal Analyzers

Sensors: Classification of sensors, characteristics and choice of sensors; Resistance, Capacitance, Inductive, Piezoelectric, Thermoelectric, Hall effect, Photoelectric, Measurement of displacement, velocity, acceleration, force, torque, strain, speed, and sound, temperature, pressure, flow, humidity, thickness, pH, position.
Block diagram of CRO, Electrostatic and electromagnetic focusing (Qualitative), Horizontal and vertical deflection system, Measurement of voltage, Frequency and phase angle. Dual trace Oscilloscope, Dual beam Oscilloscope, Sampling Oscilloscope, Digital Storage Oscilloscope. Function generator, Harmonic distortion analyzer, Wave analyzer, Spectrum Analyzer.

Unit-XV: Power Devices and Converters

Thyristor construction and characteristics, Methods of turning ON, Turn-off, effect of high di/dt and dv/dt, Snubber circuits, Gate triggering circuits, Device specifications and ratings, DIAC, TRIAC, Controlled rectifiers, AC voltage controllers.
DC-DC converters: Design of BUCK converters, BOOST converters, BUCK–BOOST converters, Forward converter, Half-Bridge converter and Full Bridge converter. Inverter: Principle of operation, performance parameters.
Inverters: Single-phase half bridge inverter, Single phase full bridge inverter.

Unit-XVI: Power Supplies and Photonic Devices

Power supplies: SMPS, UPS.
Band structure, Direct and Indirect Transitions, Spontaneous and Stimulated Recombination, P-N junctions: Heterojunctions, Carrier injection and Quasi Fermi energy, LED: Spontaneous emission spectrum, Output Power dependence and Peak Emission wavelength. Surface and Edge emitting LEDs. Efficiency Calculation of LEDs. Diode Lasers: Gain, Fabry-Perrot Cavity. Types of semiconductor diode lasers. Noise in semiconductor lasers, Introduction to photo detectors: PIN photo diode, Avalanche Photodiode.